Future Viability of the Saudi Arabian Private Sector in an Era of Fiscal Austerity

Robert E. Looney

Introduction

The main purpose of this paper is to examine the consequences of declining oil revenues on the Saudi Arabian economy during the remainder of this decade and up to 1992. In particular, the paper examines whether or not the Saudi Arabian government will be able to sustain expansion in private sector activity and, if so, under what conditions.

For this purpose:

1. A general assessment was made of the current problems and growth potential of the major areas of private sector activity. Here particular attention was given to the effectiveness of government expenditures in stimulating private sector investment.
2. Based on this assessment, together with an analysis of the major trends in the economy and the impact government expenditures have had on the various productive sectors, a macroeconomic model of the economy was constructed.
3. Linkages between the overall rate of economic growth and public sector budgetary allocations were established.
4. Finally, the pattern of private sector activity was forecast over the period of 1992 by means of several optimal control simulations.[1] These allocations were checked in terms of their consistency with the country's likely overall level of foreign assets and the government's concern with maintaining a safe level of national security through continued high budgetary allocations to defense.

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1. For background on optimal control techniques see the discussion in Homa Motamen, *Expenditure of Oil Revenue: An Optimal Control Approach with Application to the Iranian Economy* (New York: St. Martin's Press, 1979), and the references therein.

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In this context, a secondary purpose of the analysis below was to examine the budgetary ramifications of various alternative oil revenue scenarios. Specifically, we were interested in determining the sensitivity and reliance of the various private sector activities—agriculture, construction, industry, etc.—on varying levels of government expenditures. Can the private sector continue to expand or even to maintain its present levels in an era of relative government fiscal austerity?

General Constraints on Private Sector Activity

Saudi Arabia is a country of immense diversity and, until at least the period of the post 1973-74 oil boom, remained fragmented geographically and economically. In general, because of its relatively small population the kingdom suffers from small market size, which denies many local producers the advantages of economies of scale. Furthermore, since producers are dispersed geographically, they suffer from relatively high transportation and communication costs, which tend to limit opportunities for production-based export trade. These elements certainly have tended to reduce the private rate of return on many types of investment, thereby enhancing the potential for an active government role.

In addition, despite diversification, the kingdom has tended to depend to a large degree on oil products and perhaps the pilgrimage for foreign exchange earnings. As such, the country is highly vulnerable to the vagaries of external economic developments that, in turn, create the need for government intervention.

On the positive side, of course, the development of hydrocarbons has meant that the country has not had to deplete available resources which could have been diverted to capital formation to finance oil imports. In addition, the kingdom differs from most developing countries in that the economy is generally more open, so that *a priori* one would expect financial crowding out of private investment to be relatively less of a problem to the extent that domestic residents can have access to foreign financial markets when there is an excess demand for credit. It could also be argued that because of the small size of the country the government is more able to dominate the economy and thereby, total domestic capital formation.

One striking pattern characterizing Saudi Arabia's development has been the rapid expansion of government expenditures. In particular, government investment as a percent of total investment increased from slightly under 7 percent in 1960 to 42.9 percent in 1965, 53.3 percent in 1970, and 72.6 percent in 1980. The public sector's share in investment has declined

Table 1 Saudi Arabia: Relative Shares of Public and Private Sector Expenditures, 1960-1985, by Percent

	Total Investment		Total Consumption		Total Expenditures	
	Public Sector	Private Sector	Public Sector	Private Sector	Public Sector	Private Sector
1960	6.7	93.3	20.2	79.8	18.7	81.3
1961	19.3	80.7	21.9	78.1	21.5	78.5
1962	23.4	76.6	24.3	75.7	24.1	75.9
1963	31.5	68.5	31.1	68.8	31.2	68.8
1964	42.2	57.8	33.5	66.5	35.4	64.6
1965	42.9	57.1	36.2	63.8	37.9	62.1
1966	40.4	59.6	38.8	61.2	39.2	60.8
1967	55.4	45.6	40.0	60.0	43.6	56.4
1968	60.5	39.5	37.5	62.5	42.8	57.2
1969	56.3	43.7	36.1	63.9	40.1	59.9
1970	53.3	46.7	36.9	63.1	40.1	59.9
1971	41.1	48.9	72.2	62.8	39.8	60.2
1972	52.7	27.3	38.3	61.7	41.1	58.9
1973	54.4	45.6	40.3	59.7	43.4	56.6
1974	59.2	40.8	50.1	49.9	52.1	47.0
1975	52.5	47.5	46.9	53.1	48.5	51.5
1976	62.2	37.8	54.7	45.3	57.3	42.7
1977	62.3	37.7	54.4	45.6	57.3	42.7
1978	68.8	31.2	46.3	53.8	54.5	45.5
1979	71.7	28.3	47.1	52.9	56.0	44.0
1980	72.6	27.4	43.1	56.9	52.6	47.4
1981	70.0	30.0	41.7	58.3	50.9	49.1
1982	67.3	32.7	50.4	49.6	55.4	44.5
1983	66.0	34.0	48.0	52.0	53.0	47.0
1984	56.5	43.5	45.9	54.1	48.7	51.3
1985	54.2	45.8	45.1	54.9	47.3	52.7

Source: Computed from Saudi Arabian Monetary Agency, *Annual Report*, various issues.

somewhat to 54.2 percent owing to the oil price declines. Similarly, public sector consumption increased from slightly over 20 percent of total consumption in 1960 to 36.5 percent in 1965, 46.9 percent in 1975, and 50.4 percent in 1982. Again, this share fell slightly to 45.1 percent in 1985 owing to the decline in oil revenues.

The net result is that the expenditures of the public sector have risen as a percent of total expenditures from around 20 percent in 1960 to slightly over 50 percent in 1985.

This growth in the government sector has apparently not been at the expense of the private sector, with overall private sector investment expanding at slightly under 9.8 percent per annum over the 1965–85 period (Table 2).

In general, therefore, despite the huge fall in receipts, overall government spending has declined by a fairly small amount since the early 1980s. Within the total, however, there has been a steady increase in current expenditure and a decrease in spending on new projects. It is, therefore, the contractors that have been hardest hit, and the problems they have felt have been fed through to importers and manufacturers of building materials and equipment and finally to all other sectors of the economy.[2]

Recent Developments

As noted, Saudi Arabia has been experiencing widely fluctuating oil markets. This problem was particularly severe in 1986, when the decline in oil prices from a high of $28 a barrel in January 1986 to a low of $8 at mid-year called for a radical restructuring in several areas of the economy and administration.

An indication of the seriousness of the decline in the oil market became apparent in March 1986 when the 1986/87 national budget was deferred for at least five months, with public spending continuing at the average monthly level of 1985. In August 1986 the budget was deferred again because of the difficulty of predicting national revenues at a time of great uncertainty in the oil markets.

When the budget was announced on December 31, 1986, it contained a surprisingly high expenditure level of SR 170,000 million ($43,335 million), only 6 percent below that allocated in the previous fiscal year. There were also substantial allocations for capital projects—SR 50,000 ($13,335 million)—and for operations and maintenance—SR 20,000 ($5,335 million). The single largest allocation was once again for defense and security, which got SR 60,800 million ($16,215 million).

The OPEC accord reached in Geneva in December enabled the kingdom to set a higher target for oil revenues in 1987 than in fiscal 1986/86. At SR 65,200 million ($17,390), estimated oil earnings are up 6.5 percent, representing more than 55 percent of total government revenues. The rest will come from investment income—estimated at about $8 billion—and from reserves.

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2. Michael Field, "Weathering the Storm," *Financial Times* (April 21, 1986), p. I.

Table 2 *Saudi Arabia: Growth in Public and Private Sector Expenditures, 1960–85*

	Year						Average Annual Rate of Growth				
	1960	1965	1970	1975	1980	1985	1960–1970	1970–1980	1980–1985	1965–1985	1975–1985
Private Investment	0.43	0.98	1.06	2.99	4.46	6.36	9.4	15.5	7.4	9.8	7.8
Private Consumption	2.96	3.23	5.86	8.09	19.69	23.78	7.1	12.0	3.8	10.5	11.4
Private Expenditures	3.39	4.21	6.92	11.08	24.15	30.15	7.4	13.3	4.5	10.3	10.5
Government Investment	0.13*	0.73	1.21	3.30	11.84	7.54	28.1	25.6	-8.6	12.4	8.6
Government Consumption	0.87*	1.83	3.42	7.13	14.91	19.53	16.4	15.9	5.5	12.6	10.6
Government Expenditure	1.00*	2.56	4.63	10.43	26.76	27.07	18.6	19.2	0.2	12.5	10.0
Total Investment	0.45	1.71	2.27	6.29	16.31	13.90	17.6	21.8	-3.1	11.0	8.3
Total Consumption	3.72	5.07	9.28	15.22	34.50	43.32	9.6	14.1	4.6	11.3	11.0

Note: * = 1961

Source: Data from Saudi Arabian Monetary Agency, *Annual Report* (various issues).

Constant price figures derived by deflating nominal values by the non-oil GDP deflator (1970 = 1.00).

The budget allows for a deficit of SR 52,700 million ($14,055 million). In the previous budget no deficit was foreseen, but a $14,000 million shortfall was incurred. Avoiding borrowing or politically sensitive tax measures, this year's deficit will be made up from reserves estimated at around $90 billion. (This figure is not official, as the Saudi leadership has never released figures concerning the size and composition of its portfolio. The figure is, however, widely viewed as reflecting the approximate size of the government's foreign assets.)

Presumably these projections will reassure the country's private sector that the bottom has been reached in prices and production, and that hence the government will press ahead with the Fourth Five Year Development Plan—which began in 1985—without depleting reserves to levels that would be imprudent. The new oil strategy implemented in late 1986, which centered on a price of $18 a barrel, appears to be holding. Saudi Arabia's King Fahd has indicated numerous times that he would like to see prices remain stable for at least two years.

Realistically, however, it is likely that the government will face declining or at best slightly improving oil markets over the next several years. Clearly, the major problem currently facing the government is how best to utilize its dwindling oil revenues to generate positive overall rates of economic growth while at the same time meeting to the fullest extent possible the basic needs of the majority of the population.

Impact of Government Expenditures on Private Sector Investment

While the economic development literature has generally accepted the notion that increased government expenditures can stimulate private sector investment, some debate still centers around the relative merits of one variant of this strategy—Hirschman's policy of unbalanced growth.[3] Tersely put, Hirschman advocated that in countries where the private sector is somewhat squeamish about risk-taking, the government stimulates private sector capital formation through massive investments in infrastructure. Presumably, the government's investment in infrastructure would open up so many profitable areas of investment for the private sector that the initial investment would yield an extra dividend of induced easy-to-make or compelled decisions by private entrepreneurs that resulted in additional investment and output. In short, countries pursuing this strat-

egy are likely to experience abnormally high rates of private sector investment due to the incentives and pressures created by the government's investment program.[4]

While not explicitly acknowledged, Hirschman's notions of imbalance and the creation of an environment facilitating easy decision-making on the part of the private sector underlie Saudi Arabia's development strategy.[5] Since 1970, when the country initiated its first development plan, the government with the completion of the Third Plan in 1985 had allocated approximately 375 billion riyals to development infrastructure (during most of this period the exchange rate was around 3.5 Rls to the U.S. dollar).

Owing both to an exhaustion of new infrastructure projects and falling oil revenues, this phase of infrastructure-led growth appears to be over. Does this mean that the private sector will find investment possibilities less profitable to the extent that there is a general contraction in the private sector's contribution to overall capital formation: In particular, we are interested in determining: (a) whether government investment has acted as an independent (over and above oil revenues) stimulus to private sector investment; (b) whether the composition of government expenditure (between investment and consumption) affects private investment; and (c) the "best" specification of government expenditures in affecting private sector investment—i.e., whether actual changes in government expenditures are more effective than expected changes in government expenditures in stimulating private sector capital formation.

Impact of Expenditures and Revenues on Private Sector Investment

In examining the impact of government infrastructural and current expenditures on the Saudi Arabian private sector, a distributed lag scheme of the Koyck[6] type of the form

$$y = ax + byL + z \qquad \text{(Equation A)}$$

3. As originally developed in Albert O. Hirschman, *The Strategy of Economic Development* (New Haven, Conn.: Yale University Press, 1958).

4. An empirical text confirming this mechanism in Mexico is given in R.E. Looney and P.C. Frederiksen, "The Regional Impact of Infrastructure Investment in Mexico," *Regional Studies* (1981), pp. 285–96.

5. Cf. Looney and Frederiksen, "The Evolution and Evaluation of Saudi Arabian Economic Planning," *Journal of South Asian and Middle Eastern Studies* (Winter 1985), pp. 3–19.

6. L.M. Koyck, *Distributed Laga and Investment Analysis* (Amsterdam: North Holland, 1954).

was utilized. This formulation implies an exponential decay scheme whereby the effect of a once-and-for-all increase in government expenditures (or revenues) and/or private consumption (ax) not only would influence private investment expenditures during that period, but also would have (in declining terms) an impact on their level in future years.

The results of this preliminary analysis were somewhat surprising in that a one-million riyal increase in government consumption increased private investment by 140,000 riyals in the same year. Eventually, private investors would adjust their expenditures on fixed capital formation so that in the long run investment would increase by 310,000 riyals. As might be imagined, the stimulus provided by government investment is considerably lower in the short run, but is over double that provided by government consumption in the long run.

Clearly, while the above results are interesting and provide some insights as to the relative strengths of infrastructure and other expenditures on Saudi private investment, they do not reveal much about the manner in which the private sector arrives at its investment decisions.

Unfortunately, the existing literature[7] also is somewhat vague in this regard. Although there has been a great deal written on the role of the public sector in the capital formation process, and more particularly on the impact of government expenditures on private investment, the focus of most studies has been almost exclusively on the developed industrial countries.[8] In the case of developing countries, however, there was until quite recently[9] an absence of a well-established theoretical framework for analyzing investment and, apart from some isolated examples, remarkably little empirical work on the subject.

This is unfortunate since many of the questions relating to the interaction between the government and the private sector are just as important in developing countries as they are in the industrial countries. Indeed, one could argue with some justification that in view of the significant share of the public sector in total capital formation, the degree and magnitude of the administrative controls over the financial system, and the limited access of private borrowers to international capital markets, governments in developing countries would be likely to exercise a relatively greater influence over private sector investment. Certainly, even casual observation of a country such as Saudi Arabia would tend to support this view.[10]

Much of the existing literature[11] on private sector investment in developing countries tends to argue that public investment involves both the development of infrastructure—which likely would be complementary with private investment—and other types of consumption and noninfrastructural investment which may compete with private investment, either through absorbing limited physical resources or through the production of marketable output. In the aggregate, the effects of the infrastructural and noninfrastructural components can offset each other, thereby yielding the impression that the impact of total government investment on the level of private investment is weak or insignificant.

Blejer and Khan have, however, shown that once the two aspects of public sector investment are recognized, and a distinction is made along functional lines involving infrastructural and noninfrastructural investment and consumption, considerably stronger statements can be made of the role of government in private capital formation.[12]

A model along the lines suggested by Blejer and Khan modified for the unique conditions in Saudi Arabia was formulated and estimated.[13] This model is a variant of the standard accelerator model, adapted to incorporate some of the institutional and structural characteristics of the Saudi

7. Cf. the survey in G.M. von Furstenberg and B.G. Malkeil, "The Government and Capital Formation: A Survey of Recent Issues," *Journal of Economic Literature* (1977), pp. 835–78.

8. The problem of crowding out in this context is examined in K.M. Carlson and R.W. Spencer, "Crowding Out and Its Critics," Federal Reserve Bank of St. Louis, *Monthly Review* (1975), pp. 2–17; and B. Friedman, "Crowding Out or Crowding In? Economic Consequences of Financing Government Deficits," *Brookings Papers on Economic Activity* (1978), pp. 593–654.

9. The major contribution in this area has been M.I. Blejer and M.S. Khan, "Government Policy and Private Investment in Developing Countries," *IMF Staff Papers* (1984), pp. 379–413.

10. Cf. Adnan M. Abdeen and Dale Shook, *The Saudi Financial System* (New York: John Wiley, 1984), Ch. 1.

11. In particular see V. Galbis, "Money, Investment and Growth in Latin America, 1961–1973," *Economic Development and Cultural Change* (1979); P.S. Heller, "A Model for Fiscal Behavior in Developing Countries: Aid, Investment and Taxation," *American Economic Review* (1975), pp. 429–45; N.H. Leff and K. Sato, "Macroeconomic Adjustment in Developing Countries: Instability, Short-run Growth and External Dependency," *Review of Economics and Statistics* (1980), pp. 170–79; V. Sundararajan and S. Thakur, "Public Investment, Crowding Out and Growth: A Dynamic Model Applied to India and Korea," *IMF Staff Papers* (1980), pp. 814–59; and V. Tun Wai and C. Wong, "Determinants of Private Investment in Developing Countries," *Journal of Development Studies* (1982), pp. 19–36.

12. Blejer and Khan, *op cit.* [Footnote 9]. See also their "Public Investment and Crowding Out in the Caribbean Basin Countries," in Michael Connolly and John McDermott, eds., *The Economies of the Caribbean Basin* (New York: Praeger Publishers, 1985), pp. 219–36.

13. The model together with its complete database is available on request from the author.

Arabian economy. A number of problems tend to limit the applicability of a strict version of the neoclassical investment model to developing countries set forth by Jorgenson,[14] Hall,[15] and others, although there have been a few attempts in this direction.[16] By and large these problems make it necessary, as indicated by the Koyck results above, to modify the basic model to place greater emphasis on the effects of oil revenues in alleviating the effects of financial resource constraints usually faced by private investors in developing countries. Clearly, a proxy for expectations of the future economic climate also has to be explicitly introduced.

To start, we hypothesize that the response of gross private investment to the gap between desired and actual investment, as measured by b in Equation (A), is not a fixed parameter, but rather varies systematically with economic factors that influence the ability of private investors to achieve the desired level of investment.

We assume the ability to respond on the part of the private sector depends on two main factors: first, the availability of financing,[17] and second, the level of public sector investment. In recent years a clear consensus has emerged that, in contrast to the case of industrial economies, one of the principal constraints on investment in developing countries is the quantity of financial resources rather than their costs. The rudimentary nature of capital markets in Saudi Arabia, however, limits the financing of private investment to the use of retained profits, bank credit, and, in particular, government subsidies.[18] An increase in real credit to the private sector will, other things being equal, directly encourage real private sector investment, and by rolling over bank loans that maturity of debt can be lengthened sufficiently to correspond to the length of the investment project. Subsidies either direct or indirect by the government to the private

sector, while very important, are, given the data, somewhat difficult to pin down. For purposes of estimates here, they are assumed to vary more or less in line with the level of oil revenues.

In Saudi Arabia's case, non-oil revenues consist largely of import duties and as such are a fairly good barometer of changing economic conditions. They are, therefore, introduced here as a proxy for the investment "climate."

In general our findings[19] indicated the importance of the long-run distributed lag relationship between oil revenues and private sector investment. The strong statistical significance of non-oil revenues undoubtedly reflects the importance of the general level of economic activity on private sector plans for increased capital formation. Interestingly enough, private sector credit, the change in GDP, and the change in government investment were all insignificant in affecting private sector investment.

On the other hand, the gap between actual government investment and the expected level of government investment was positive and statistically significant.

Apparently, the Saudi private sector responds rapidly and positively to unanticipated increases in government investment. This response is much more sensitive to unanticipated increases in government expenditures than to simple increases in government expenditures.

The picture that emerges from these results is one wherein the Saudi private sector has responded strongly to the opportunities provided by expanded oil revenues, presumably through their long-run role in expanding the country's infrastructure.

The private sector also appears very sensitive to current economic conditions as proxied by non-oil revenues.

Finally, in this longer-run estimate, the private sector apparently responds rapidly to the stimulus of unanticipated government investments which may contain a significant noninfrastructural component.

In sum, infrastructure investment appears to have played a strong role in stimulating private sector investment as predicted by Hirschman. In addition, the private sector appears especially affected by unanticipated increases in public sector investment.

On the other hand government consumption produced a markedly different pattern from that obtained for government investment. Here, while the changes in both government consumption and investment are gener-

14. D.W. Jorgenson, "The Theory of Investment Behavior," in R. Ferber, ed., *Determinants of Investment Behavior* (New York: Columbia University Press, 1967), pp. 129–55; and D.W. Jorgenson, "Econometric Studies of Investment Behavior: A Survey," *Journal of Economic Literature* (1971), pp. 1111–47.

15. R.E. Hall, "Investment, Interest Rates and the Effects of Stabilization Policies," *Brookings Papers on Economic Activity* (1977), pp. 61–103.

16. Cf. V. Sundararajan and S. Thakur, *op. cit.* [Footnote 11].

17. Interest rate movements due to Islamic law are not a factor in inducing or inhibiting local private investment. There is, however, some flexibility in overcoming the prohibition on interest. See, for example, Robert E. Looney, "Saudi Arabia's Islamic Growth Model," *Journal of Economic Issues* (June 1982), pp. 453–60; and Mohsin Khan and Abba Mirakhor, "Islamic Banking System in Iran and Pakistan," *The Journal of Social, Political and Economic Studies* (Fall 1986), pp. 317–26.

18. Abdeen and Shook, *op. cit.* [Footnote 10], Ch. 1.

19. Again a detailed working paper containing the results of the regression analysis is available upon request from the author.

ally positive and significant, unanticipated levels of consumption exert a strong negative impact on private investment. Apparently real crowding out of private investment, or difficulties in an absorptive capacity, occur largely in the form of unexpectedly large increases in government consumption.

The results obtained above contain both optimistic and pessimistic implications for the Saudi economy over the next few years of slack oil revenues. First, the results confirm the leading role government infrastructure has played in stimulating private sector investment. The government's strategy of leading with infrastructure—with the expectation that this would, à la Hirschman, stimulate private sector investment—has been shown to be valid. The ongoing increase in real private investment in the period of oil revenue declines reflects this phenomenon.

On the other hand, one major stimulus to private sector investment, unexpected increases in government investment, appears with the decline in oil revenues to be largely out of the picture for the immediate future. This can be offset, however, by a corresponding reduction in unexpected government consumption.

It is not at all clear how long past infrastructure investments can continue to stimulate private sector investment. While the long-run impacts of government investment were shown to be strong, the extent to which they must be sustained to create adequate incentives for new private sector capital formation is uncertain.

As noted above, the main thrust of the analysis below is to develop an optimal fiscal program designed to maximize the impact government expenditures have on private sector activity. The analysis rests on the presumption that Saudi Arabia can be characterized as a country with sufficient oil reserves to have its longer-run economic future secure, but not enough current revenues to sustain growth rates in the ranges to which the country has become accustomed.

The econometric, optimal control model of the economy developed in the next section attempts to build on the preliminary analysis of private sector investment, through identifying a specific set of governmental fiscal policies and their financial implications consistent with the achievement of both renewed growth and socio-economic improvement over the remainder of the 1980s.

Description of the Model

The model contains both monetarist and Keynesian elements, variations of which have been developed for various countries.[20]

Ordinary least squares regression was used in the exploratory stage of model building, when much experimentation with various possible explanatory variables was undertaken to decide on the choice of variables and the form of the structural equations included. However, two-stage least squares technique was later used for the final estimations of parameters of the model to correct for any simultaneous equation bias in the estimates.[21] The estimation procedure was carried out using the national account statistics for the years 1960–85 and the sectoral figures for the years 1965–85. The national account and budgetary figures were deflated using the GDP deflater (1970 = 1.0). The model developed below is a simple simulation model, designed to incorporate the possibilities of both discretionary and nondiscretionary policy alternatives. The first stage of the model—the monetary block—contains 13 equations.[22] The main features of the model (Table 3) include:

1. The money supply is a direct function of government expenditures (Equation 8, Table 3);
2. non-oil gross domestic product is estimated by a quantity theory type function whereby the growth in real non-oil income is assumed dependent on both the rate of growth in the money supply and the rate of growth in velocity, and is inversely related to the consumer price index (Equation 10, Table 3);
3. inflation is dependent on the growth in money, world (imported) inflation and (in the case of the non-oil gdp deflater) growth in income (Equations 9 and 12, Table 3);
4. the velocity of money (M1) increases with increased opportunity cost of holding money (as proxied by the euro interest rate and the expected rate of inflation).

20. A description of the validity of this type of model is given in Robert E. Looney, "Prerevolutionary Iranian Economic Policy Making: An Optimal Control Based Assessment," *Economic Modelling* (October 1985), pp. 357–68. A similar model dealing the Mexican economic crisis is developed in R.E. Looney, *Economic Policy Making in Mexico: Factors Underlying the 1982 Crisis* (Durham, North Carolina: Duke University Press, 1985).

21. Cf. Ray C. Fair, *Specification, Estimation and Analysis of Macroeconomic Models* (Cambridge: Harvard University Press, 1984), Ch. 2, for a rationale for this approach. Estimations were made using the TSP program developed at Stanford University. See B. Hall and R. Hall, *Time Series Processor, Version 3.5 User's Manual* (Stanford, California: B. Hall and R. Hall, 1890) for a description of the estimation procedure.

22. The equations were estimated using two-stage least squares estimations to eliminate any possible simultaneous equation bias. Nominal exports, the rate of world inflation, and the euro interest rate were assumed exogenous to the system.

(1) Growth in Oil Revenue (GGROX) = 0.85 GEN + 0.49 GENL
                           (9.27)   (11.83)

(2) Growth in Non-oil Revenue (GNOR) = 0.83 GGROX
                               (2.6)

(3) Growth in Government Revenue (GGRX) = 0.89 GGROX + 0.06 GNOR
                             (9.37)   (2.09)

(4) Growth in Monetary System Foreign Assets (GMSFA) = 1.20 GGROX
                                    (8.37)

(5) Growth in Commercial Bank Credit to the Private Sector (GCBPS) =
    0.45 GGEX + 0.15 GMSFA
    (2.28)   (1.94)

(6) Growth = Government Deficit (GGDEF) = GGRX – GGEX

(7) Growth = Government Expenditures, National Accounts (GGENAN) =
    0.48 GGEX + 0.29 GGENANX + 0.15 GGROX
    (2.83)   (1.98)   (2.06)

(8) Growth in Money Supply (GMIX) = 5.71 + 0.38 GGEX + 0.27 GGEXL
                          (2.04) (4.88)   (3.68)

(9) Inflation; Non-oil GDP Deflation (INFN) =
    0.58 GMIX + 0.38 INFNL – 0.45 GYX
    (5.94)   (1.96)   (– 2.14)

(10) Growth in Real Non-oil GDP (GYX) =
    0.62 GMIX + 1.04 GVMIX – 0.68 INFC
    (4.87)   (2.81)   (– 1.79)

(11) Inflation: Consumer Price Index (INFC) = 0.25 GMIX – 0.38 INFN
                             (5.47)   (2.10)

(12) Growth in Velocity of Money (GVMIX) = 0.32 EUROR + 0.18 INFNE
                            (2.11)   (2.09)

(13) Expected Inflation (INFNE) = INFNL – INFNL2

Exogenous Variables, World Inflation (INFW), Real Euro Interest Rate (EUROR),
Exports (GEN)

Note: L indicates lagged 1 year, L2 indicates lagged 2 years.

In short, the model links the money supply with government expenditures. The growth in real non-oil gdp was in turn determined by the overall growth in the money supply, and any increase in the velocity of money. The stability of velocity (and hence the validity of the quantity model used here) was confirmed by the fact that regressions of the growth of money on the growth of velocity were not statistically significant.

The second stage of the model, the real (current price) expenditure and private sector block (Table 4), contains 17 equations in all. These consist of expenditure, private sector output, and identity equations. The transition from the monetary (current price) model was made by deflating government expenditures, commercial bank credit, and the money supply by the non-oil gdp deflater.

One of the main features of the sectoral output section of the model was the systematic incorporation of military expenditures into a number of the private sector output relationships.

Empirically, it appears (Table 4) that increased defense expenditures have tended to have a negative impact on non-oil manufacturing, while stimulating mining, construction, wholesale and retail trade, services, and the income derived from ownership of dwellings. The overall net impact of military expenditures on private sector output (not shown here) was also positive and statistically significant.

In general, therefore, military expenditures have not been neutral in the Saudi Arabian context, but instead have retarded a key sector, while apparently providing a net stimulus to several other sectors. It should be noted that based on the t statistic, military expenditures were more significant in most cases than either government consumption or investment expenditures in stimulating private sector output.

Similar exercises were also undertaken to determine the net effect of military expenditures on the major sources of demand. In particular, have increased allocations to defense *ceteribus paribus* diverted funds from investment? Using a distributed lag formulation, it appears that:

(1) In general, military expenditures have had a net positive impact on overall gross capital formation and investment in the kingdom. That is, after controlling for government expenditures and oil revenues, increases in military expenditures have had a stimulating effect on gross capital formation. The same also applies to non-oil investment; here however, the size of the coefficient (0.30) is over one-half that of government investment (0.79).

(2) Military expenditures do not appear to stimulate either total private

Table 4 Saudi Arabia: National Income and Sector Output Simulation Model (Two-stage least-squares estimation)

(1) Government Consumption (GCNP) = 0.20 GEXP + 0.60 GCNPL
$$\quad\quad\quad (5.04) \quad\quad\quad (6.25)$$

(2) Government Investment (GINP) = 0.22 GEXP
$$\quad\quad\quad (30.70)$$

(3) Total Government Expenditures-National Income Accounts (GENANP) = GCNP + GINP

(4) Private Consumption (PCNP) = 0.60 PCNPL + 0.09 GEXP + 0.23 CBPSP
$$\quad\quad\quad (3.01) \quad\quad\quad (2.36) \quad\quad\quad (2.10)$$

(5) Private Expenditure (PENANP) = PCNP + PINP

(6) Defense Expenditure (SIPRIP) = 0.46 GENANP
$$\quad\quad\quad (46.96)$$

(7) Agricultural Credit (AGCRP) = 0.0134 GENANP
$$\quad\quad\quad (10.12)$$

(8) Agricultural Output (AGP) = 0.97 AGPL + 0.42 AGCRP
$$\quad\quad\quad (22.61) \quad\quad\quad (2.76)$$

(9) Mining Output (MINP) = 0.31 MINPL + 0.0057 GINP − 0.011 SIPRIP
$$\quad\quad\quad (1.77) \quad\quad\quad (2.40) \quad\quad\quad (3.15)$$

(10) Non-Oil Manufacturing (MUP) = − 0.455 SIPRIP + 0.82 PENANP
$$\quad\quad\quad (− 2.38) \quad\quad\quad (8.66)$$

(11) Construction (CP) =
0.46 GCPL + 0.14 GINP + 0.16 SIPRIP + 0.62 D75X + 0.04
$$(9.27) \quad\quad (5.63) \quad\quad (3.91) \quad\quad (2.57) \quad\quad (2.10)$$

(12) Transportation/Communication (TSCP) =
0.29 TSCPL + 0.24 MIP − 0.93 D75 + 0.31
$$(4.04) \quad\quad (7.84) \quad\quad (− 6.73) \quad\quad (4.04)$$

(13) Wholesale-Retail Trade (WTP) =
0.68 WTPL + 0.084 SIPRIP + 0.049 MIP − 0.37 D75 + 0.07
$$(9.15) \quad\quad (4.06) \quad\quad (2.05) \quad\quad (− 2.91) \quad\quad (3.10)$$

(14) Services (CDP) = 0.03 SIPRIP + 0.04 PCNP
$$\quad\quad\quad (2.13) \quad\quad\quad (3.70)$$

(15) Finance (FOP) = 0.62 FOPL + 0.07 MIP
$$\quad\quad\quad (5.63) \quad\quad\quad (2.77)$$

(16) Ownership of Dwellings (FODP) =
0.07 SIPRIP + 0.17 PINP + 0.33
$$(2.41) \quad\quad (2.43) \quad\quad (5.85)$$

(17) Private Sector Output (YP) = AGP + MINP + MOP + CP + TSCP + WTP + CDP + FOP + FODP

Variables from Monetarist simulation model: Government Expenditures (GEXP) Money Supply (MIP), Commercial Bank Credit (CBPSP)

Dummy Variables: D75, D75X

Note: L indicates lagged 1 year

sector expenditures or private sector consumption. Again, government investment appears particularly productive in contributing to this source of private sector demand.

(3) Interestingly enough, military expenditures appear to induce private sector investment, whereas government investment seems to crowd out or preempt resources that might otherwise flow toward this activity.

(4) Military expenditures do not appear to impact nearly as adversely on imports as the overall level of government expenditures.

(5) In the net, military expenditures appear to contribute more to overall demand than government consumption. The stimulating effect of military expenditures on other types of government investment (especially in light of the negative effect of government consumption on investment) tends to reinforce this effect.

In short, while it might seem apparent that shifting public allocations from military toward more "productive" activities would result in stimulating or at least preventing a decline in private sector demand and growth over the next several years, the results presented above indicate that broad generalizations of this type, if not incorrect, are at least somewhat misleading. Military expenditures in the Saudi context appear at least to have (in addition to their security value) a number of significant impacts on the private sector, most of which are not negative.

In particular, some private sectors of the economy appear to derive more of a stimulus from military expenditures than from other forms of government allocation. The same also applies to the overall level of investment in the kingdom.

The results do suggest that a careful shifting of government allocations from consumption to capital formation (providing profitable areas of investment have not been exhausted)—rather than across-the-board reductions in military expenditures—is the most productive policy open to the authorities for contributing to private sector expansion.

Since the model was designed largely for the purpose of examining the impact of government fiscal activity under alternative fiscal programs (associated with an assumed set of developments in the hydrocarbon sector), a relatively large number of public policy variables appear in the final estimated equations. More specifically, the model formulation allows the problems of government deficits, portfolio depletion, and public/private expenditure balance to be examined within the context of a set of simultaneous equations. Total government expenditures were assumed to be the main policy variable at the disposal of the authorities.

As noted, the parameters of the model time series observations covering

the period 1960–1985 were utilized in estimating. The first part of this period can be characterized as an environment of fairly steady if not spectacular growth, and the second half by significant structural changes in the government's revenue and expenditure patterns. As might be imagined, this period is characterized by an environment of high but extremely erratic growth patterns. Consequently, uncorrected for structural change, it is possible that some of the parameter estimates derived from regressions for the period as a whole would provide a description of what happened in the economy during this period only in an average sense.

To correct for the structural shifts in the 1970s and 1980s, a number of dummy variables were introduced into the model.[23] As noted above, several of the dummy variables—D75 and DX75—were statistically significant in several of the simulation equations. The first dummy, D75, is a simple shift dummy, assuming historical values of 0 for the period 1960–74, and 1 for the period 1975–85. The dummy DX75 assumed values of 0 for the period 1960–74, 2 for the period 1975–82, and 1 for the period 1983–85. The first dummy is a simple shift dummy reflecting the structural change that took place in 1974–75 as a result of the oil price increases; the second dummy is a bit more subtle in that it also takes into account the post-1982 oil revenue decline experienced by the kingdom. Both dummies assumed values of 1 for the forecast period. In order to determine the sensitivity of the results obtained from the alternative fiscal programs in the optimal control simulations, two contrasting[24] forecasts of export earnings were made:

1. "Recovering Oil Markets": −16.0%, 1986; +1.0%, 1987; +2.0%, 1988; +3.0%, 1989; +4.0%, 1990; +5.0%, 1991; and +6.0%, 1992.
2. "Declining Oil Markets": −16.0%, 1986; −2.0% per annum over the 1987–92 period.

These two oil scenarios are intended to map out the most favorable and unfavorable of environments in which government fiscal policy can be conducted.

The Model's Use in Forecasting

As noted, the model is driven by the values assigned to variables assumed to be exogenous to the Saudi Arabian economy and a policy variable, the growth in government expenditures given specified annual deficits. In terms of exogenous variables:

1. World inflation is set at 2.0% per annum;
2. The euro interest rate is held constant at 7.0%;
3. The exchange rate is set at 3.745 Rls per $US.

The maximum rate of domestic inflation consistent with the maintenance of a stable exchange rate was set at 5.0 percent per annum. Admittedly, this is an arbitrary figure; however, it was assumed that world inflation at 2.0 percent rates over 5.0 percent would eventually result in a significantly over-valued riyal.

Major Findings

In simulating the economy to determine the sensitivity of the forecasts to alternative oil revenue assumptions and fiscal programs, the control model was set to optimize the level of real private sector output in 1992. The loss function was inflation, i.e., the optimal control model steered the economy on a path over time that resulted in a minimal rate of inflation consistent with the values of the government's policy variables. As noted above, the chief policy variable (the design variable in optimal control terminology) assigned to the Saudi authorities was the increase in government expenditures under alternative deficit constraints.

The main findings (Tables 5 and 6) of these simulations were that:

23. The dummy variables were introduced to determine the nature of the structural change, i.e., did oil revenue increases in the 1970s result in shifts in the intercept of the regression and/or changes in the slope of the regression equation? The shifts associated with increased oil revenues represent quantum changes in expenditures, while changes in the slope of the regression equation are indicative of the country's absorptive capacity for increased oil revenues. For a description of this methodology, see Ragaei El Mallakh and Mihssen Kadhim, "Absorptive Capacity, Surplus Funds, and Regional Capital Mobility in the Middle East," *Rivista Internazionale di Science Economiche e Commerciali* (April 1977), pp. 308–27. See also Robert E. Looney, "Absorptive Capacity of the Prerevolutionary Iranian Economy," *The Journal of Energy and Development* (Spring 1983), pp. 319–40; and R.E. Looney," The Impact of Petroleum Exports on the Saudi Arabian Economy" in Robert W. Stookey, ed., *The Arabian Peninsula* (Stanford, California: Hoover Institution Press, 1984), pp. 37–64, for applications of this methodology.

24. These assumptions represent two extremes in the recent forecasting literature. See, for example: Samuel A. van Vactor and Arlon Tussing, "Retrospective on Oil Prices," *Contemporary Policy Issues* (July 1987); Douglas Bohi, "Evolution of the Oil Market and Energy Security Policy," *Contemporary Policy Issues* (July 1987); George Georgiou, "Oil Market Instability and a New OPEC," *World Policy* (Spring 1987); Yasuhiro Watanabe, "Supply and Demand for Petroleum—Results for 1986, and Forecasts for 1987," *JIME*

Review (Spring 1987); and Walter J. Mead, "The OPEC Cartel Thesis Reexamined: Price Constraints from Oil Substitutes," *Journal of Energy and Development* (Spring 1986).

Table 5 Saudi Arabia: Macroeconomic Forecasts, 1986-1992, Fiscal Budgetary Target, $10 Billion Range, Alternative Oil Market Environments (Billions 1970 riyals)

| | Actual | | | | Forecast | | | | Average Annual Growth |
	1985	1986	1987	1988	1989	1990	1991	1992	1985-92
I Fiscal Deficit, Declining Oil Revenues (Billion $)	-11.98	-12.52	-6.58	-10.00	-10.00	-10.00	-10.00	-10.00	-69.10*
Government Budgetary Expenditures (current riyals)	216.0	180.4	146.1	158.9	152.9	150.0	147.2	144.3	-5.6
Total Government Expenditures	27.1	25.4	22.5	21.9	21.3	20.8	20.3	19.9	-4.3
Government Consumption	19.3	18.2	16.4	15.6	15.0	14.6	14.3	14.0	-4.5
Government Investment	7.5	7.2	6.1	6.4	6.3	6.2	6.1	6.0	-3.1
Military Expenditures	12.14	11.73	10.3	10.1	9.8	9.6	9.4	9.2	-3.8
Total Private Expenditures	30.1	30.5	29.6	29.1	28.7	28.2	27.8	27.4	-1.3
Private Consumption	23.8	24.2	23.5	23.3	23.1	22.8	22.6	22.3	-0.9
Private Investment	6.4	6.3	6.1	5.8	5.6	5.4	5.2	5.1	-3.2
Private/Government Expenditures	-1.11	1.20	1.32	1.33	1.35	1.36	1.37	1.38	3.2
Inflation (Non-Oil Price Deflator)	-1.98	-6.62	-4.41	1.82	-0.79	-0.41	-0.32	-0.24	-.-
Money Supply (M1)	14.1	13.3	12.1	12.4	12.3	12.2	12.1	11.9	-2.4
Non-Oil GDP	34.3	33.2	31.3	32.5	33.0	33.0	33.3	33.5	-0.3
Government Revenue (Current riyals)	171.5	133.5	121.5	118.4	115.4	112.5	109.7	107.9	-6.4

| | Actual | | | | Forecast | | | | Average Annual Growth |
	1985	1986	1987	1988	1989	1990	1991	1992	1985-92
I Fiscal Deficit, Declining Oil Markets (Billion $)	-11.98	13.60	-9.10	-9.34	-8.26	-9.47	-10.00	-10.00	-69.77*
Government Budgetary Expenditures (current riyals)	216.00	184.4	158.8	162.3	162.4	174.0	183.9	193.3	-1.6
Total Government Expenditures	27.1	25.6	23.3	22.6	22.2	22.4	23.0	23.7	-1.9
Government Consumption	19.5	18.3	16.9	16.0	15.6	15.6	15.8	16.2	-2.6
Government Investment	7.5	7.3	6.5	6.6	6.6	6.9	7.2	7.4	-0.2
Military Expenditures	12.1	11.8	10.7	10.4	10.2	10.3	10.6	10.9	-1.5
Total Private Expenditures	30.1	30.6	30.0	29.6	29.4	29.5	29.9	30.5	0.2
Private Consumption	23.7	24.2	23.9	23.7	23.7	23.9	24.3	24.8	0.7
Private Investment	6.4	6.4	6.1	5.9	5.7	5.6	5.6	5.6	-1.9
Private/Government Expenditures	1.11	1.20	1.29	1.31	1.32	1.32	1.30	1.29	2.2
Inflation (Non-Oil Price Deflator)	-1.98	-6.13	-3.09	0.57	-4.23	2.03	1.60	1.78	-.-
Money Supply (M1)	14.1	13.4	12.5	12.6	1.26	13.0	13.3	13.6	-0.5
Non-Oil GDP	34.3	33.4	32.1	32.9	33.5	34.5	35.7	36.7	1.0
Government Revenue (Current riyals)	171.5	133.5	124.7	127.3	131.5	137.5	145.6	155.8	-1.4

Table 6   *Saudi Arabia: Private Sector Viability, 1986–1992, Fiscal Deficit Target, $10 Billion Range, Alternative Oil Market Environments, (Billions 1970 riyals)*

	Actual 1985	Forecast 1986	1987	1988	1989	1990	1991	1992	Average Annual Growth 1985–92
Fiscal Deficit, Declining Oil Revenues (billion $)	−11.98	−12.52	−6.582	−10.00	−10.00	−10.00	−10.00	−10.00	−69.10*
Private Sector Output	26.46	25.39	23.94	23.40	22.99	22.60	22.28	21.99	−2.6
Agriculture	1.78	1.87	1.93	1.99	2.05	2.10	2.14	2.19	3.0
Mining	0.24	0.25	0.23	0.22	0.22	0.21	0.21	0.21	−1.9
Manufacturing	1.99	1.98	1.96	1.93	1.91	1.88	1.86	1.83	−1.2
Construction	7.53	6.99	6.38	6.10	5.92	5.78	5.67	5.57	−4.2
Wholesale-Retail Trade	4.71	4.63	4.40	4.24	4.11	3.99	3.88	2.79	−3.1
Transportation	3.96	3.77	3.41	3.39	3.37	3.32	3.27	3.23	−2.9
Services	1.40	1.25	1.19	1.17	1.15	1.14	1.12	1.11	−3.3
Ownership of Dwellings	2.35	2.22	2.08	2.02	1.96	1.91	1.87	1.83	−3.5
Finance & Banking	2.43	2.44	2.36	2.33	2.31	2.28	2.26	2.24	−1.2
Credit to Private Sector									
Commercial Bank	10.09	9.54	8.96	9.02	8.97	8.85	8.76	9.66	−2.2
Agricultural Credit	0.40	0.34	0.30	0.29	0.29	0.28	0.27	0.27	−5.5

	Actual 1985	Forecast 1986	1987	1988	1989	1990	1991	1992	Average Annual Growth 1985–92
Fiscal Deficit, Recovering Oil Market (billion $)	−11.98	−13.60	−9.10	−9.34	−8.26	−9.47	−10.00	−10.00	−69.77*
Private Sector Output	26.46	25.50	24.28	23.86	23.56	23.65	23.97	24.43	−1.1
Agriculture	1.78	1.87	1.94	2.00	2.06	2.12	2.18	2.24	3.3
Mining	0.24	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.0
Manufacturing	1.99	1.98	1.98	1.96	1.95	1.95	1.98	2.00	0.1
Construction	7.53	7.03	6.51	6.24	6.09	6.08	6.15	6.27	−2.6
Wholesale-Retail Trade	4.71	4.64	4.47	4.32	4.21	4.16	4.16	4.20	−1.6
Transportation	3.96	3.80	3.53	3.48	3.47	3.54	3.63	3.74	−0.8
Services	1.40	1.26	1.21	1.20	1.19	1.20	1.22	1.26	−1.5
Ownership of Dwellings	2.23	2.23	2.12	2.06	2.01	2.00	2.01	2.04	−2.0
Finance & Banking	2.43	2.44	2.39	2.37	2.35	2.37	2.40	2.43	0.0
Credit to Private Sector									
Commercial Bank	10.09	9.58	9.14	9.22	9.28	9.44	9.64	9.84	−0.4
Agricultural Credit	0.40	0.31	0.31	0.30	0.30	0.30	0.31	0.32	−2.3

(1) In general, inflation presents no particular difficulties in the range of expenditures likely to be undertaken by the government.

(2) Given present levels of foreign asset holdings, fiscal deficits averaging around $10 billion per year are probably the maximum the government would be able to sustain over the 1987–92 period without recourse to external borrowing.

(3) Private sector demand (consumption and investment) appears relatively resilient, i.e., it does not decline nearly as rapidly as government expenditures during periods of declining oil revenues and/or fiscal austerity.

The most significant finding of these simulations was that private sector output as a whole is likely to continue declining and would regain a positive rate of expansion only under the most favorable set of assumptions concerning oil markets and sustainable levels of government expenditures. In part, however, this result is conditioned by the fact that much of the kingdom's major construction works is now completed—the construction sector would contract irrespective of developments in world oil markets.

(4) In all scenarios private sector demand will have to increase vis-à-vis that of the government to levels not experienced since the pre-1973/74 oil price increases. On the other hand, the ratios of private to government expenditures are not higher and in many cases are lower than those experienced in the early-to-mid-1960s."

(5) Agriculture appears to be the sector activity capable of sustaining the highest overall rates of growth over the 1986–92 period.

(6) Reducing military expenditure (given a specified budgetary target) does not stimulate private sector output growth.

Implications for the Future

Since the 1973 oil price increases, the central feature of the Saudi Arabian government's longer-run development strategy has been the need to use petroleum export revenues to place the economy on a high growth trajectory that will eventually lead to self-sustaining private sector growth, a major goal of the government. This orientation, together with the oil revenue forecasts summarized above, imply that the current financial crisis is a temporary one that is likely to be alleviated when oil markets revive in the

early 1990s. Within this context, however, it is apparent that there is not a specific set of governmental fiscal-financial policies consistent with the achievement of both renewed growth and socio-economic improvement over the remainder of the 1980s.

More significantly, it appears that—given likely developments in the oil markets and without major changes in national priorities (in terms, for example, of the willingness of the government to initiate external borrowing)—it is unlikely that the private sector will be able to sustain positive overall rates of economic growth over the 1986–92 period.

Therefore it is clear that, despite vast amounts of public sector expenditure since 1973/74, the kingdom's fortunes remain inextricably linked with the world oil market. The Fourth Five Year Development Plan (1985–90) has run into a number of problems. Despite government budgetary deficits of around $10 billion in 1983, '84, and '85, the Plan's targets now seem unrealistically ambitious. Nevertheless it still provides a pointer in the direction which the government wants to see the economy moving.

One of the basic messages of the Plan is that the state, having made massive investments in establishing a modern infrastructure, wants the private sector to shoulder more of the investment burden and eventually to emerge as the main force in the economy. The forecasts above show that under reasonably conservative assumptions concerning oil revenues and government deficits there may be fairly buoyant private sector demand (presumably based on past savings). If this is in fact the case, a key area for private sector growth is in non-oil industrial activity. Currently there are about 2,000 producing industries representing a total investment of about SR 60,000 million ($16 billion).²⁶ Given that local output currently accounts for only 15 percent of goods consumed in the kingdom—the rest being imported—there is room for expansion. Imports, which were down by 28 percent from 1984, were widely expected to fall an additional 30 percent in 1986. Given relatively buoyant demand on the part of the private sector, greater shifts toward local manufacturers than those anticipated by the forecasts above might be possible. If this is in fact the case, the overall rates of private sector output should be more in line with private sector demand.

25. As a basis of comparison the ratio of private to government expenditures averaged 3.0 over the period 1960–64; 1.4 for the 1965–69 period; 1.3 for the 1970–74 period; 0.8 for the 1975–79 period; and 1.1 for the 1980–85 period. In most of the simulations undertaken here this ratio increased to the 1.35 range.

26. "Saudi Arabia: Revival Predicted by Early 1990s," *Middle East Economic Digest* (December 20, 1986). p. 60.